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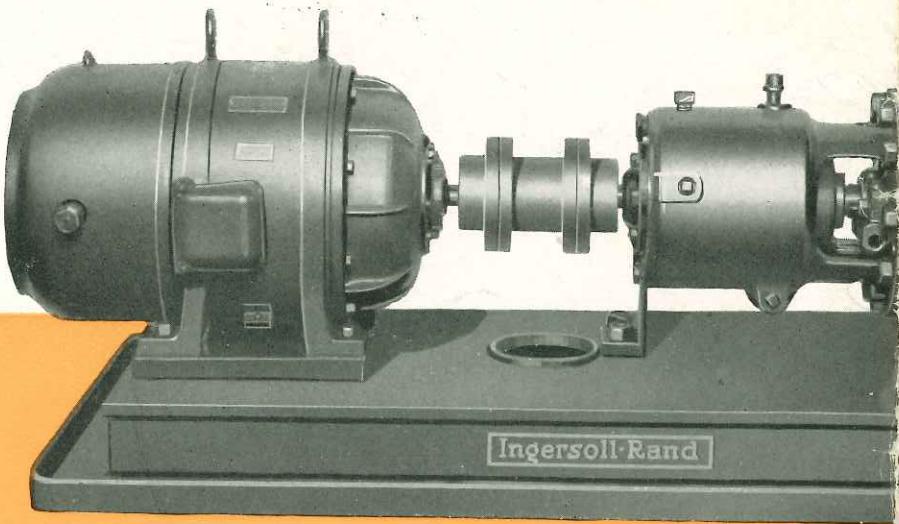
APR 30 1946

U. S. PATENT OFFICE

# PROCESS PUMPS

SINGLE-STAGE TYPES HFL, MFL, SFL, BHFL, BMFL AND BSFL

**Ingersoll-Rand**  
CAMERON PUMP DIVISION



**Class SFL-MFL-HFL process pumps with top suction and discharge. They are available in 1½ to 4" discharge sizes.**

Cameron single-stage process pumps are built for general service in the refinery and process industries. They will handle liquids at temperatures from below freezing up to 800°F. These pumps are available for capacities up to 3200 gal per min and in a wide range of material combinations to suit the liquid being pumped.

Every practical feature contributing to dependable operation and low maintenance cost has been incorporated in the design. Among these features are; extra-deep stuffing boxes arranged for water-cooling, ring-oiled ball bearings with cooled oil reservoir, double impeller wearing rings, a single head gasket, self-venting vertical suction nozzle, centerline support, and hooked-type shaft sleeves that can expand freely when handling high-temperature liquids.

These pumps may be equipped with the Cameron Shaft-Seal in place of the conventional stuffing-box. For many process services this seal saves liquid and reduces stuffing-box maintenance. Additional details on the Shaft-Seal are given on page 8.

## Metallurgical Facilities

The proper selection and heat treatment of materials used in pumps has an important bearing on their performance in the field. Ingersoll-Rand has an outstanding metallurgical laboratory with complete equipment for the quality control of materials going into manufactured equipment. I-R metallurgists will be glad to specify the proper materials for pumps handling unusual or difficult liquids.

## Pump Testing Laboratory

The facilities of Ingersoll-Rand Company for testing pumps are unexcelled by any pump manufacturer. They include complete equipment for accurately measuring horsepower, capacity, and for controlling speed, head, suction conditions, etc.

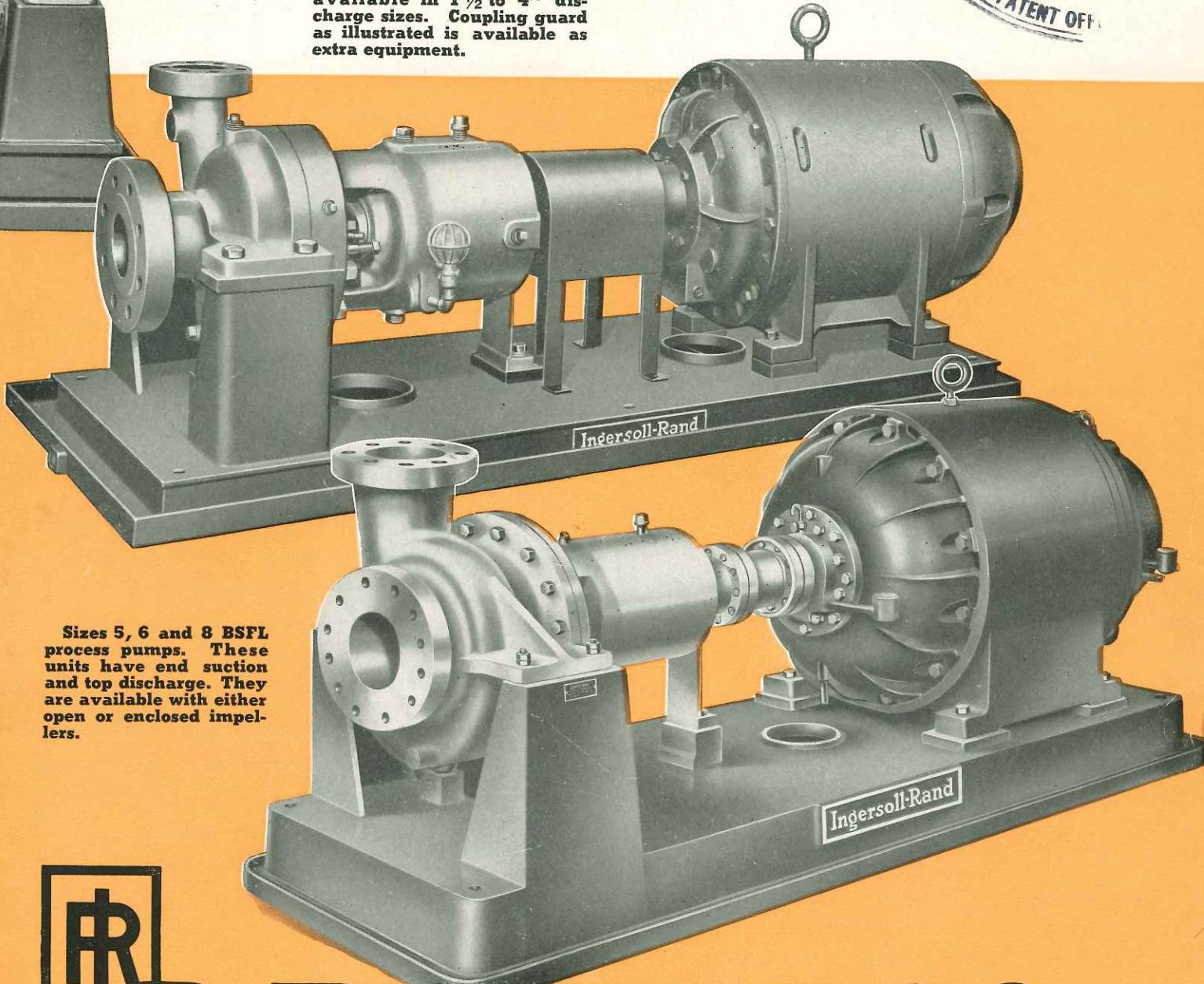
Completed pumps are thoroughly tested in this modern laboratory to insure a high standard of mechanical performance and to check head, capacity and other characteristics throughout the complete operating range.

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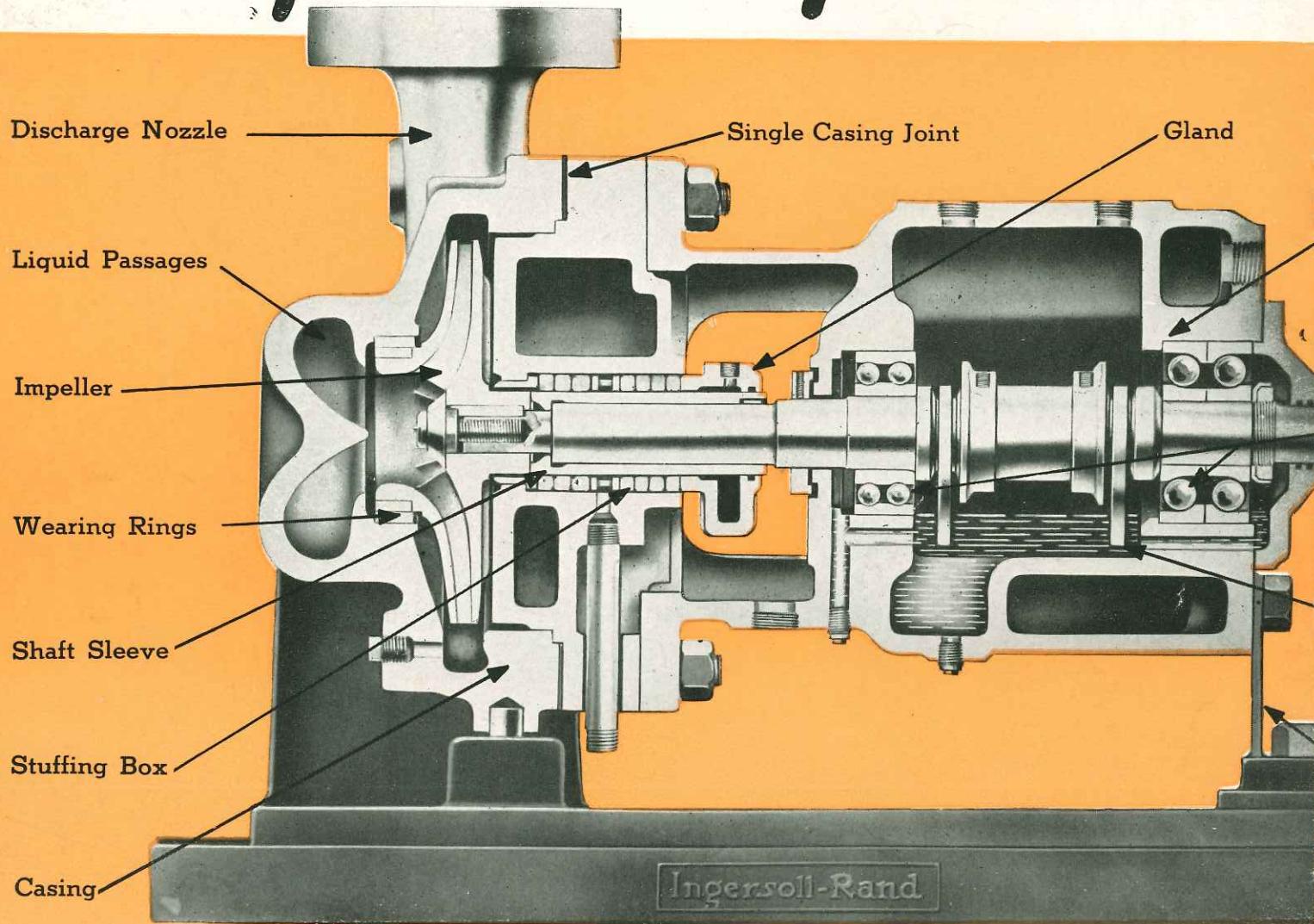
Class BSFL-BMFL-BHFL process pumps with end suction and top discharge. They are available in 1 1/2 to 4" discharge sizes. Coupling guard as illustrated is available as extra equipment.



Sizes 5, 6 and 8 BSFL process pumps. These units have end suction and top discharge. They are available with either open or enclosed impellers.

R  
PROCESS  
Pump

# Important Features



Cross section of sizes 1½ to 4 SFL, MFL, and HFL. These units have top suction and discharge.

## Impeller

An efficient, single-suction, closed-type impeller is used. It is balanced both mechanically and hydraulically. A complete selection of impellers enables our engineers to exactly fit your conditions.

## Flexible Foot

The bearing housing is supported on a flexible foot which provides rigidity at the same time allowing longitudinal directional expansion when

## Shaft-Sleeve

The shaft sleeve is of the expansion type, free to expand when handling hot liquids. A metal-to-metal joint between the impeller and sleeve, plus packing under the sleeve, prevents leakage along the shaft.

## Suction Nozzle

The vertical suction nozzle makes the pump self-venting.

## Casing

Casing is vertically split and is extra heavy to withstand working pressures up to 600 psi.

## Wearing Rings

Double wearing rings seal the entrance to the impeller. Wearing rings are welded in place. Where conditions are such that minimum stuffing-box pressure must be attained, wearing rings can be supplied on the back of the impeller at slight extra cost.

## Bearing Housing

The bearing housing is simple and compact. It allows quick and easy disassembly of the pump without disturbing the pipe connections. See page 7.

of



# PROCESS Pumps

Bearing Housing

Bearings

Lubrication System

Flexible Foot

SIZES  $1\frac{1}{2}$  TO 4

## Stuffing-Box

The stuffing-box is extra deep and arranged for water cooling. When packed solid it will hold 8 or 10 rings of packing, depending on the size. It may be arranged for injection and bleed off, circulation, injection, etc. For many services the Cameron Shaft-Seal can be used in place of packing. See page 8.

## Gland

The stuffing-box glands are of the smothering type. They are split so they can be completely removed to give easy access to the stuffing box.

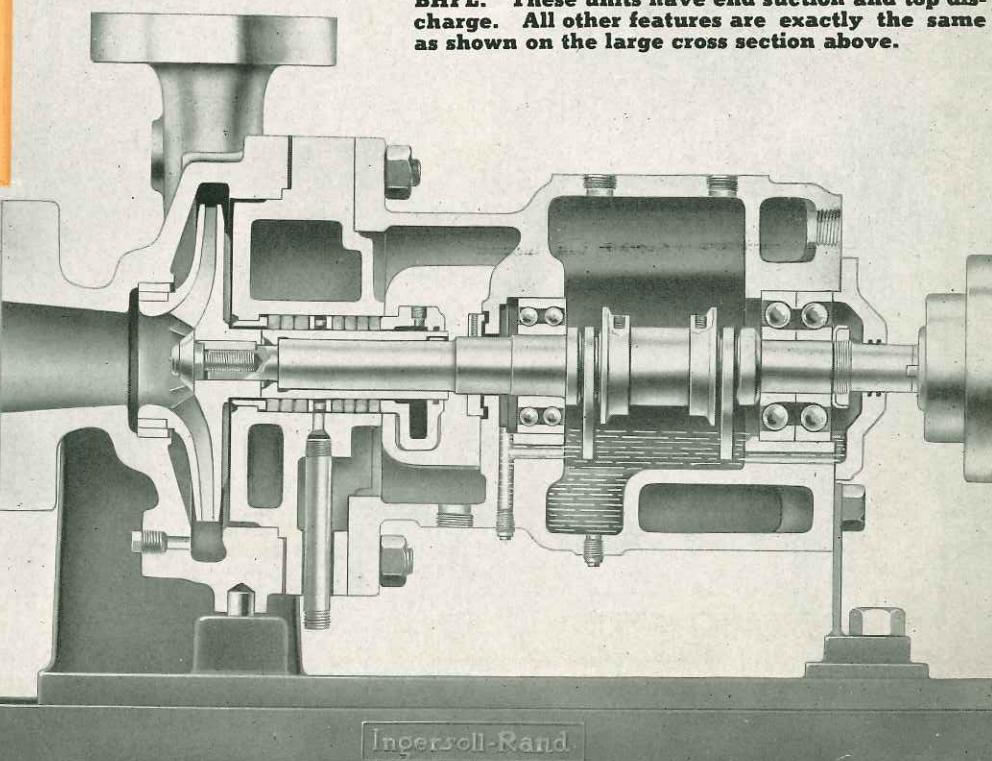
## Lubrication System

Positive lubrication of the bearings is assured by oil rings running on the shaft and carrying oil from the reservoir in the cradle. A constant-level oiler provides ample reserve oil and permits quick inspection of the oil supply. The oil reservoir is completely water jacketed. Inspection plugs directly over the oil rings allow observation of the lubricating action.

## Single-Casing Joint

The casing has a single joint fitted with a metal-clad gasket. This makes it easy to dismantle the unit. No internal gaskets are used.

Cross section of sizes  $1\frac{1}{2}$  to 4 BSFL, BMFL, and BHFL. These units have end suction and top discharge. All other features are exactly the same as shown on the large cross section above.

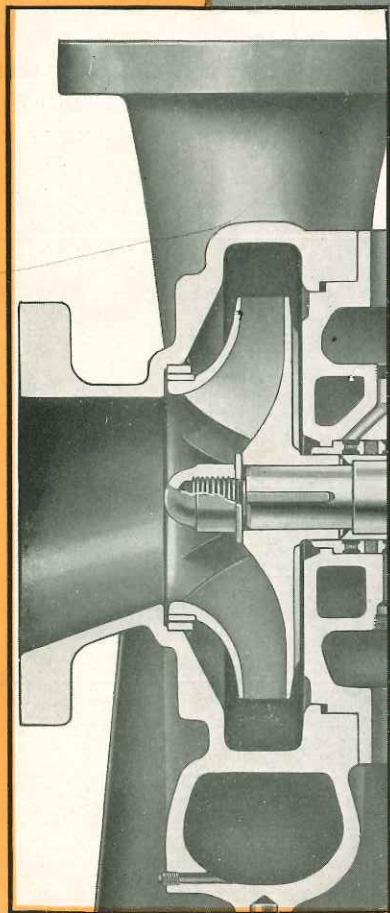
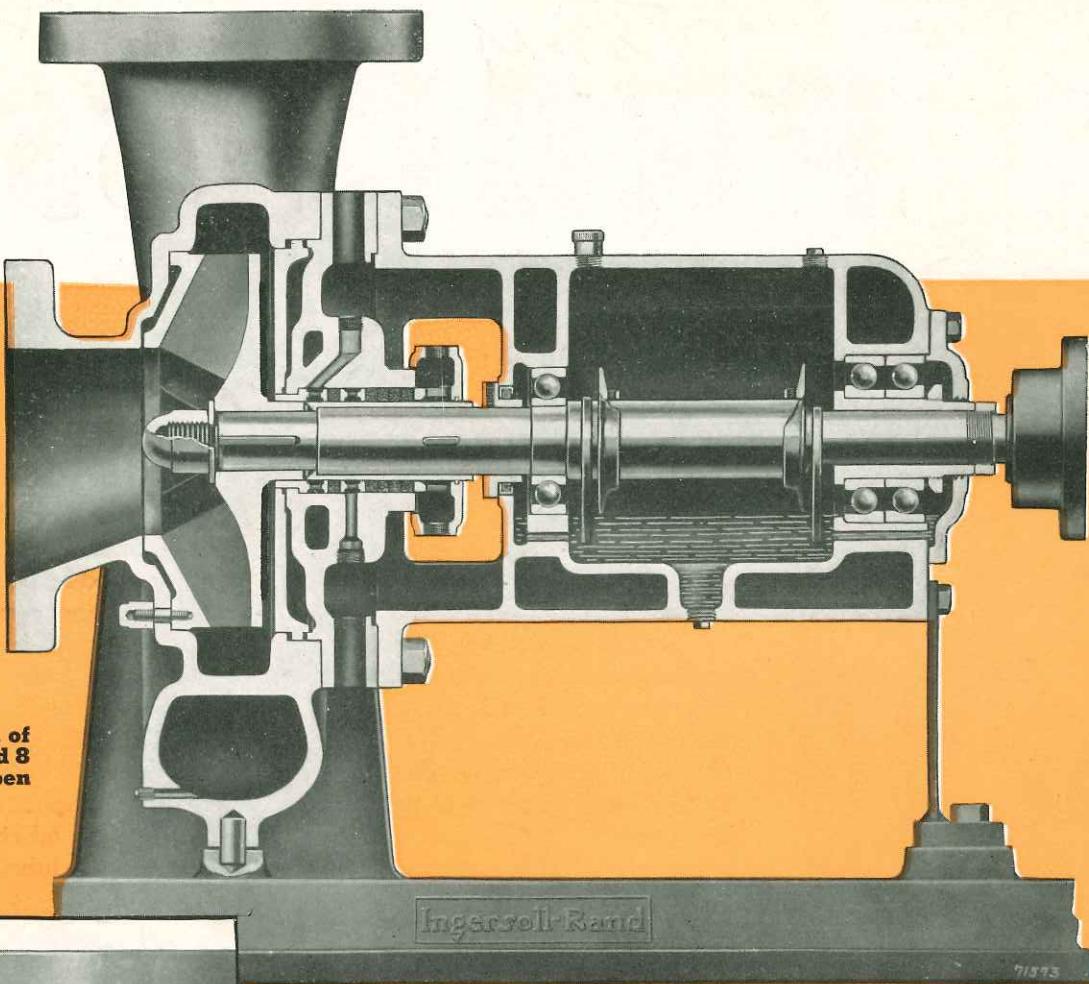


## Bearings

The thrust bearing consists of two, matched, angular-contact ball bearings mounted back to back. The radial bearing is free to move longitudinally in the housing and thus compensates for any differences in expansion and contraction between the casing and shaft when handling hot liquids.

## Liquid Passages

All liquid passages and volutes are carefully designed and proportioned for maximum performance.



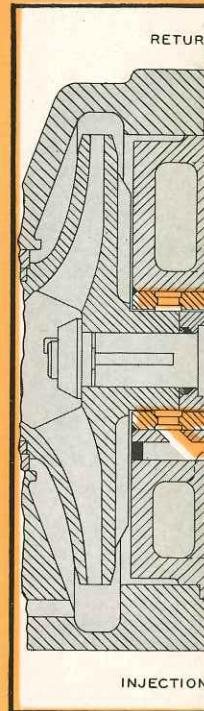
## Large-Capacity Pumps

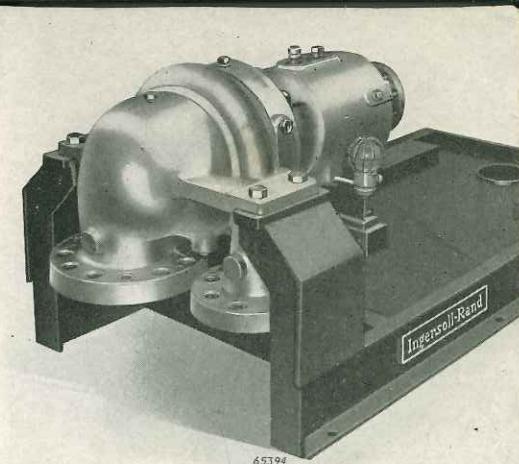
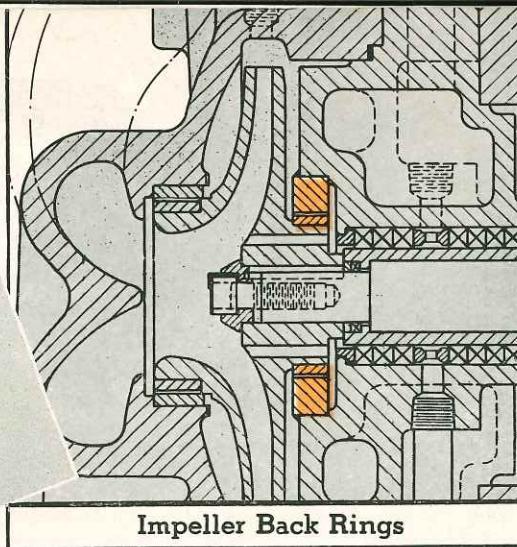
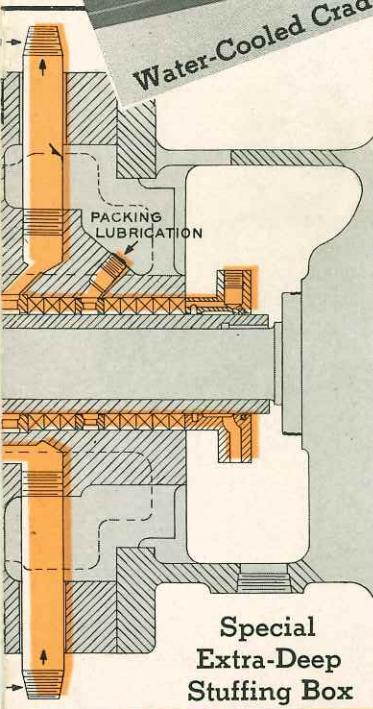
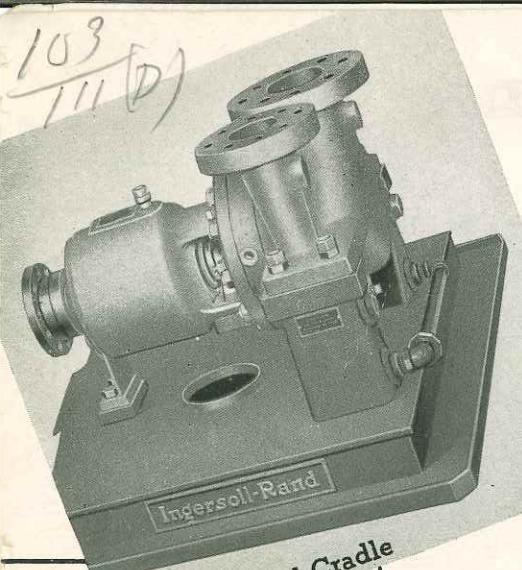
Cameron Size 5, 6 and 8 BSFL process pumps provide capacities up to 3200 gal per min. They have end suction and top discharge and are of the same general construction with the same features as the smaller units described on the previous page. They will handle liquids at temperatures up to 800°F at maximum working pressures of 300 psi.

These units are ideal for bottom circulation or slurry service and other applications requiring larger capacity than the smaller process pumps. They are available with either open or closed impellers. When open impellers are used, renewable front and back casing shrouds are provided. An accessible adjusting device to take up wear on the impeller face has been provided outside the cradle at the thrust-bearing end of the pump.

Both the closed and open impeller units are equipped with patented Leakollector gland. This gland collects all stuffing-box leakage and makes separate drains and catch basins unnecessary. It is provided with a tap for the introduction of smothering liquid. It is of split construction so that it may be completely removed from the shaft. For many services the Cameron Shaft-Seal can be used in place of packing. See page 8.

Closed impeller as supplied  
on 5, 6 and 8 BSFL pumps.





Reverse Mounting

## Process Pump Modifications

Cameron process pumps have been designed particularly for refinery and process service. The standard construction is, therefore, satisfactory in most instances. A number of modifications are available at slight extra costs for special services.

**Reverse Mounting . . .** In cases where bottom suction and discharge is desired, the casing can be mounted in reverse. Since units mounted thus are not self-venting, a suitable vent connection is provided.

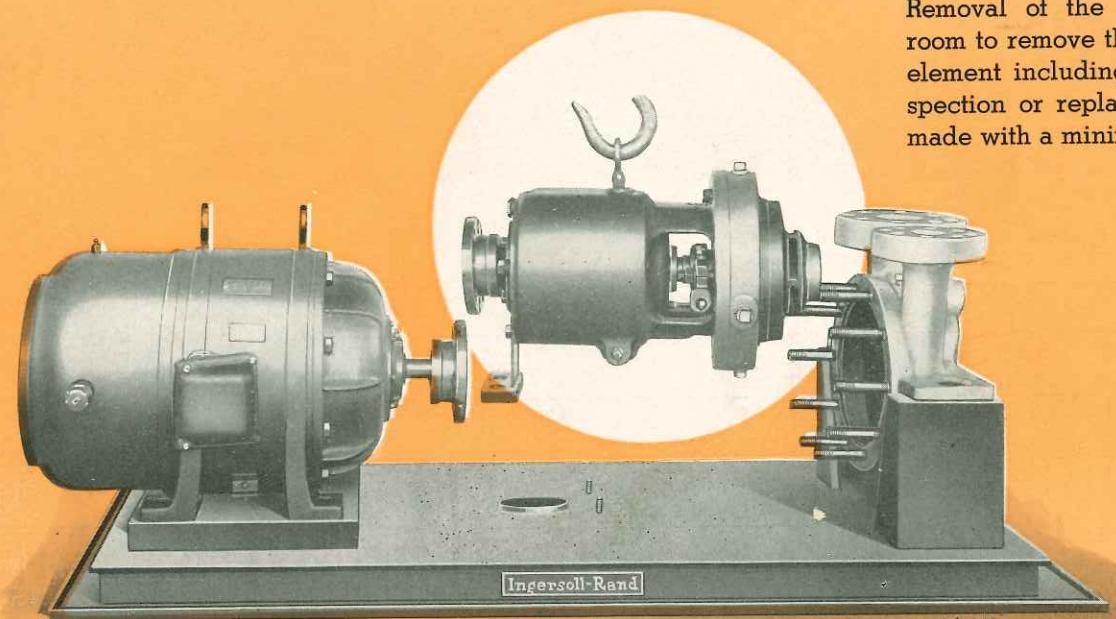
**Impeller Back Rings . . .** Vanes on the back of the impeller of standard units reduce the pressure on the stuffing box to about half of the developed head. In cases where the

stuffing-box pressure must be reduced to suction pressure, a set of double wearing rings can be provided at the back of the impeller.

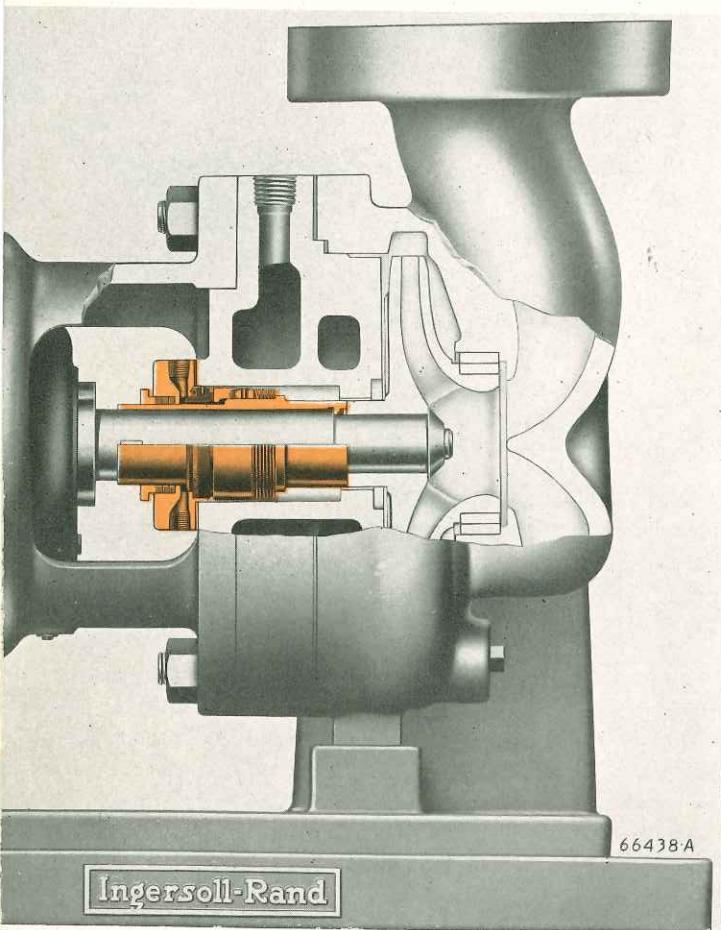
**Water-Cooled Cradle . . .** Although ample provision has been made in the standard pump to compensate for temperature differences, a water-cooled cradle can be furnished when desired.

**Extra-Deep Stuffing Box . . .** Where acids or other liquids are handled and stuffing-box leakage must be kept at a minimum, extra-deep stuffing boxes can be supplied. The Shaft-Seal, described on page 8, also is often ideal for such services.

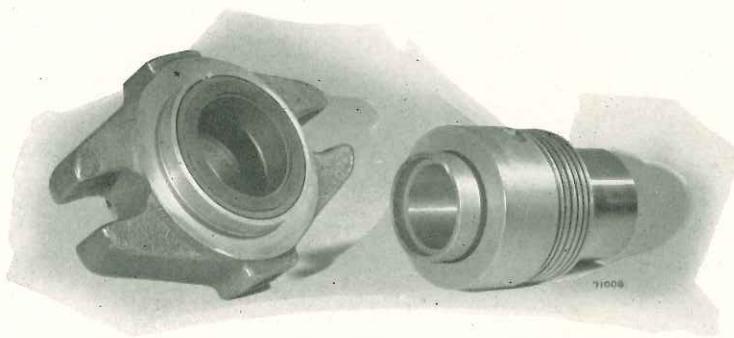
## Easy to Dismantle



Cameron process pumps may be easily and quickly dismantled without disturbing the driver or the suction and discharge piping. Removal of the spacer-type coupling allows room to remove the entire bearing and rotating element including the impeller as a unit. Inspection or replacements can thus be quickly made with a minimum of interruption to pumps.

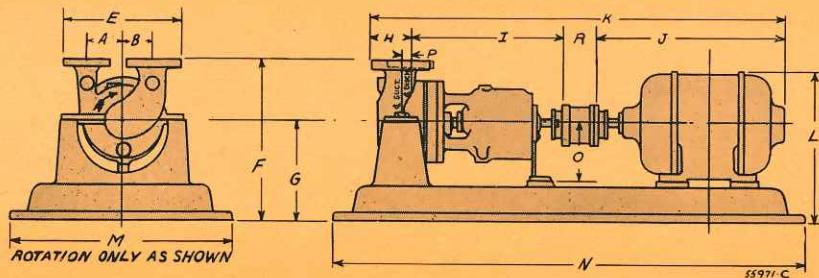


The complete Shaft-Seal. Pumps may be ordered equipped with this seal or it may be installed on Cameron pumps already in service.



The Cameron Shaft-Seal installed on a process pump.

## APPROXIMATE



SFL - MFL - HFL

Pump	Diameter		A	B	E	F*	G*	H	I	J*	K*	L*	M*	N*	O	P	R
	Suct.	Disch.															
1½SFL 1½MFL	2½ 2½	1½ 1½	5½ 5¾	21¾ 3	15½ 5¾	20¾ 21½	11¾ 12¾	47/8 5	21½ 24¾	291/8 251/16	59½ 59¾	22½ 20½	25 29	66 62½	8 8½	1 1¼	4¾ 4¾
2SFL 2MFL 2HFL	3 4 4	2 2 2	5½ 5¾ 7½	3½ 3½ 6	17½ 17½ 22½	20¾ 22½ 29	11¾ 12¾ 17	5¾ 6¾ 9¾	21½ 24½ 24½	29½ 30½ 71¾	60½ 65½ 24½	22½ 24½ 32	27 29 76	66 63 10	8 8½ 10	1½ 1½ 3½	4¾ 4¾ 4¾
3SFL 3MFL 3HFL	4 4 4	3 3 3	6¾ 6½ 5½	4½ 4½ 23½	19½ 19½ 29	21½ 23½ 29	11¾ 13¾ 17	6½ 7 10	21½ 24½ 24½	35½ 32½ 75½	67½ 68½ 27½	25½ 29 32	28 29 81	8 10 10	1½ 2 4½	4¾ 5 5	
4SFL 4MFL 4HFL	6 6 6	4 4 4	6¾ 6½ 8½	5¾ 5½ 5½	24 23½ 26½	22½ 24½ 31	11¾ 13¾ 19½	8½ 8½ 12½	21½ 24½ 24½	39½ 33½ 79½	73½ 71 79½	26½ 27½ 31½	30 29 37	82 69 86	8 10 10	1¾ 1½ 5½	4¾ 5 5
6FL	8	6	9¾	5¾	29½	34	19	11½	27½	40½	84½	33½	39½	78	8	2½	5

\*Dimensions vary with size, make and type of driver.

All dimensions in inches.

# USED WITH INGERSOLL-RAND

## Process Pumps

The Cameron Shaft-Seal replaces conventional stuffing-box packing. It is ideal for use on refinery and process pumps.

Some of the advantages of the seal over conventional packing are:

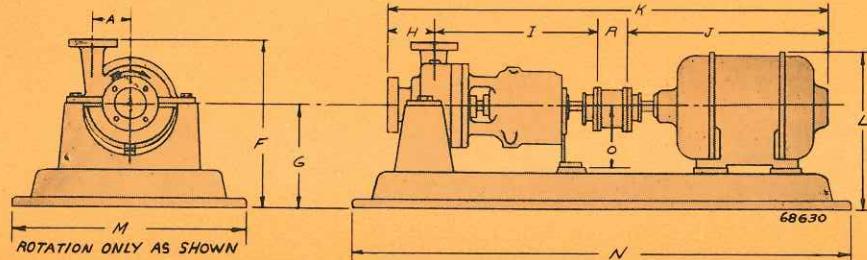
1. Once installed it requires no further adjustment.
2. It reduces losses, which in a conventional box, are due, to leakage, friction and recirculation from bleed-off devices.
3. Low, controlled contact pressure between the sealing faces allows its use for high stuffing-box pressures and for liquids having poor lubricating qualities.
4. A single, balanced seal can be used in most cases. This eliminates the need for any outside lubricant or sealing fluid.

The Shaft-Seal is successfully handling cold liquids with good lubricating properties at stuffing box pressures up to 600 psi; liquids with poor lubricating properties at stuffing-box pressures up to 400 psi; and liquids at temperatures up to 350°F at stuffing-box pressures up to 400 psi.

While a single-seal will handle most liquids, a double-seal is available for handling liquids of a very corrosive nature or liquids at high temperatures.

The sealing action of the Shaft-Seal takes place between two ring-shaped faces, one stationary and the other rotating. The construction is simple but highly effective. It eliminates the need for special packings, hardened shaft sleeves, bleed-off devices and injection of outside liquids to lubricate packing.

## DIMENSIONS



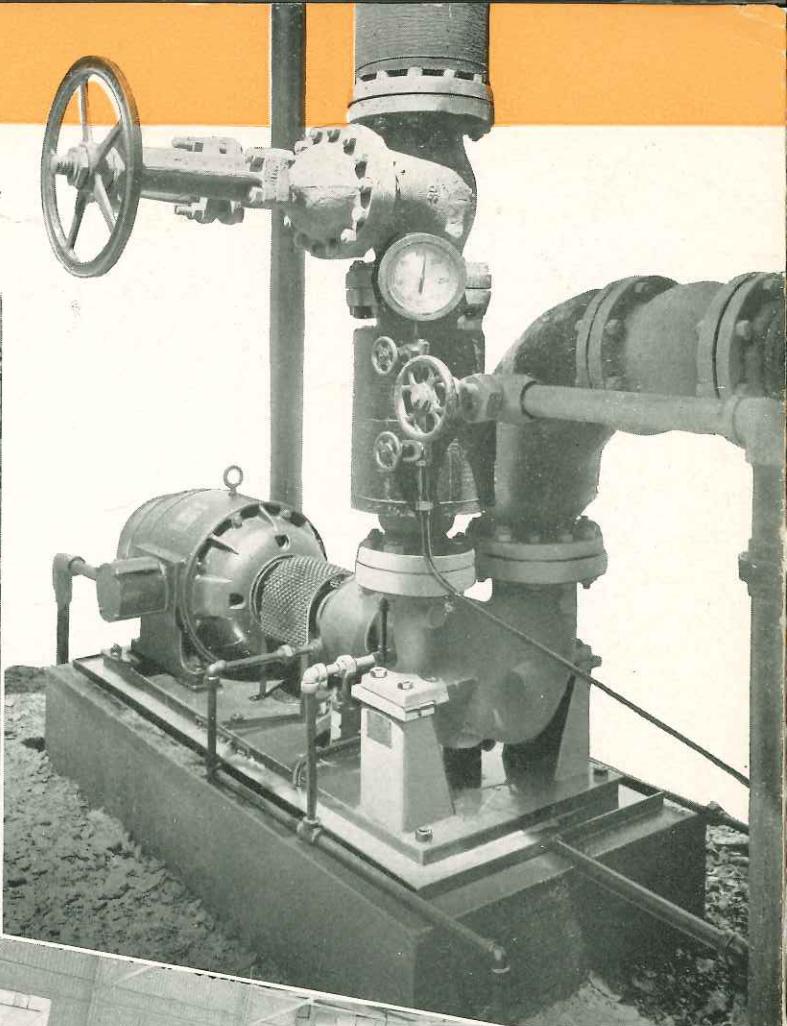
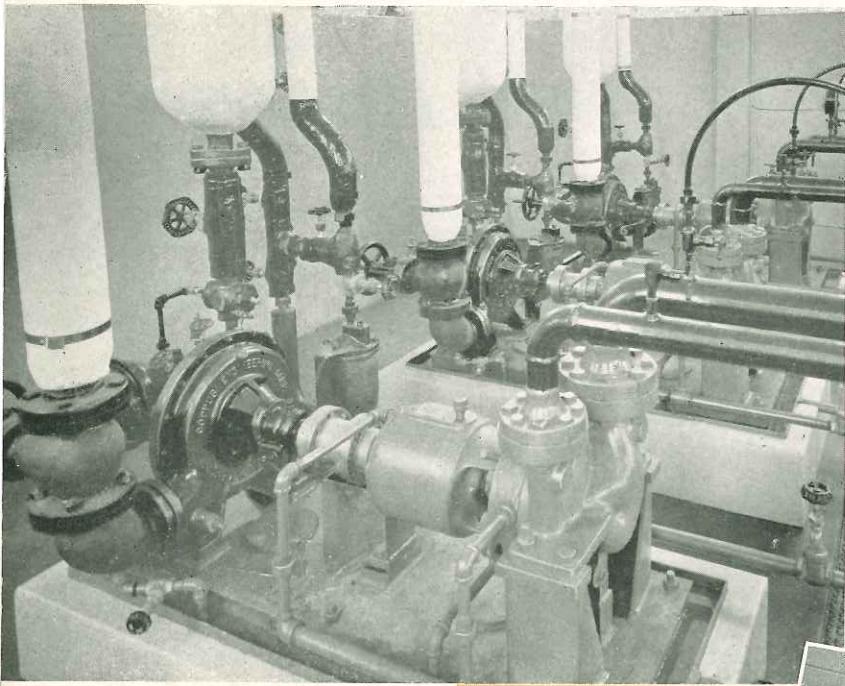
BSFL - BMFL - BHFL

Pump	Diameter		A	F*	G*	H	I	J*	K*	L*	M*	N*	O	R
	Suct.	Disch.												
1½BSFL 1½BMFL	2½ 2½	1½ 1½	5½ 5½	20¾ 21½	11¾ 12½	7	21½ 24½	29½ 25½	62 61½	22½ 20½	25 29	66 62½	8 8½	4¾ 4¾
2BSFL 2BMFL 2BHFL	3 4 4	2 2 2	5½ 5½ 7½	20¾ 22½ 29	11¾ 12½ 17	7 7½ 24½	21½ 24½ 24½	29½ 30½ 33½	62½ 66½ 69½	22½ 24½ 27½	27 29 32	66 63 76	8 8½ 10	4¾ 4¾ 4¾
3BSFL 3BMFL 3BHFL	4 4 4	3 3 3	6¾ 6¾ 8	21½ 23½ 29	11¾ 13¾ 17	7½ 7½ 24½	21½ 24½ 24½	35½ 32½ 35½	68½ 69½ 72½	25½ 27½ 27½	28 29 32	75 68 81	8 10 10	4¾ 5 5
4BSFL 4BMFL 4BHFL	6 6 6	4 4 4	6¾ 6¾ 8½	22½ 24½ 31	11¾ 13¾ 19½	7½ 8 24½	21½ 24½ 24½	39¾ 33½ 37½	73½ 70½ 73¾	26¾ 27½ 31½	30 29 37	82 69 86	8 10 10	4¾ 5 5
5BSFL 6BSFL 8BSFL	6 8 10	6 6 8	11½ 12½ 13½	38¾ 41 41	22½ 23 23	7½ 8½ 9½	36¾ 35¾ 36	39 47¾ 49	88½ 103½ 105½	37½ 38 39½	50 50 52	96 108 110	16½ 16½ 16½	5 5 11½

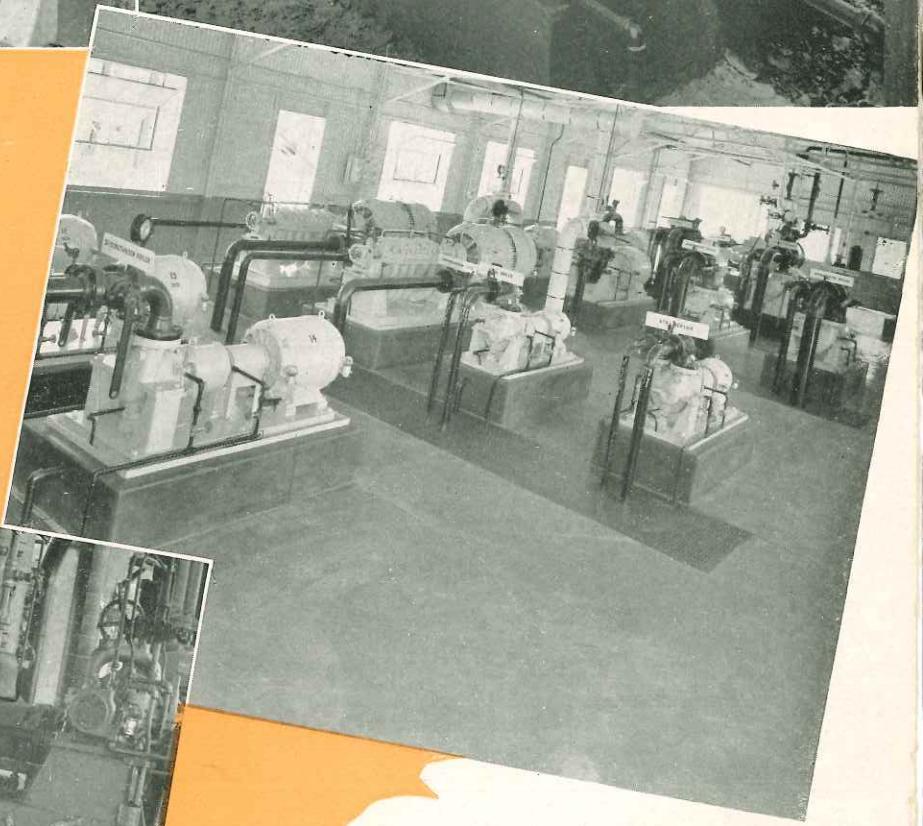
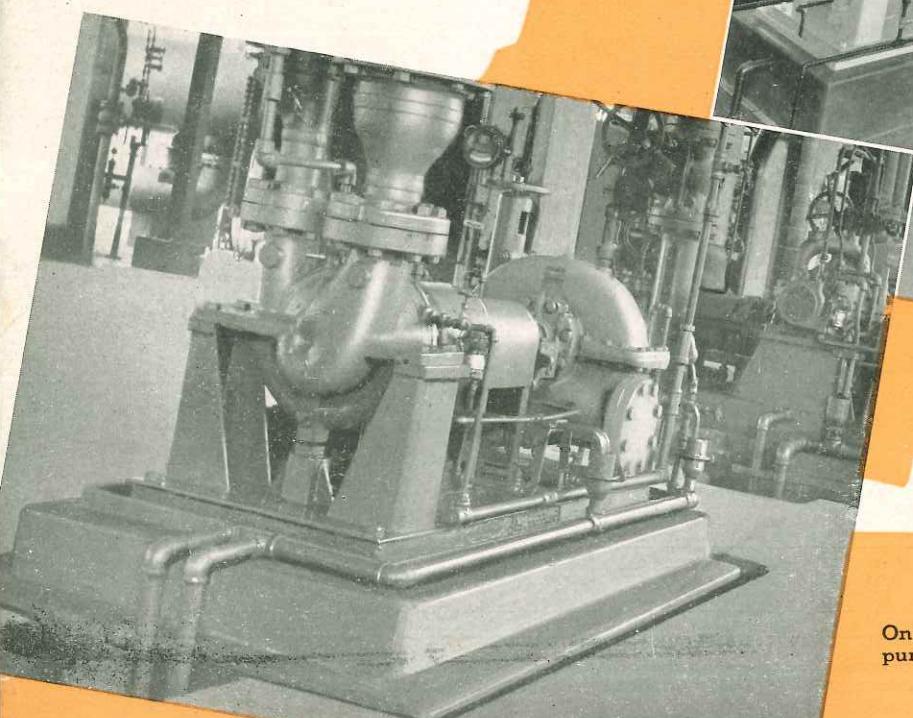
\*Dimensions vary with size, make and type of driver.

All dimensions in inches.

A Size 4 SFL pump serving stabilizers in a refinery.



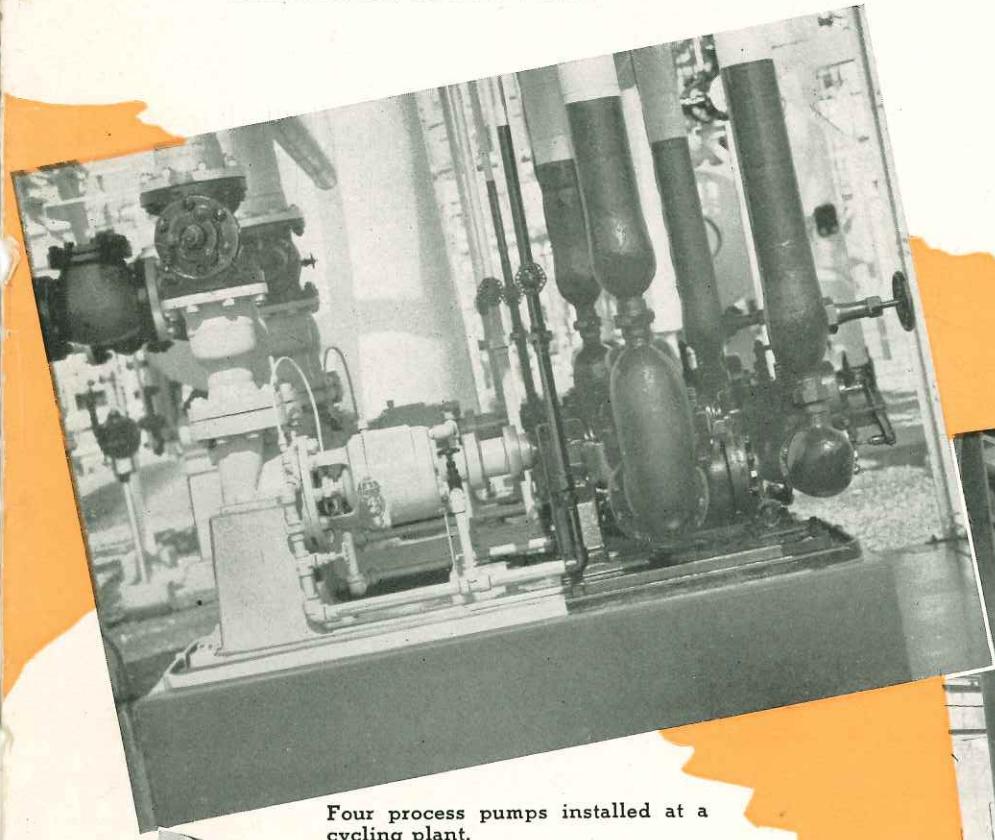
Three SFL pumps installed in a natural gasoline plant.



Process pumps in a cycling plant.

One of a large number of I-R process pumps in a butadiene plant.

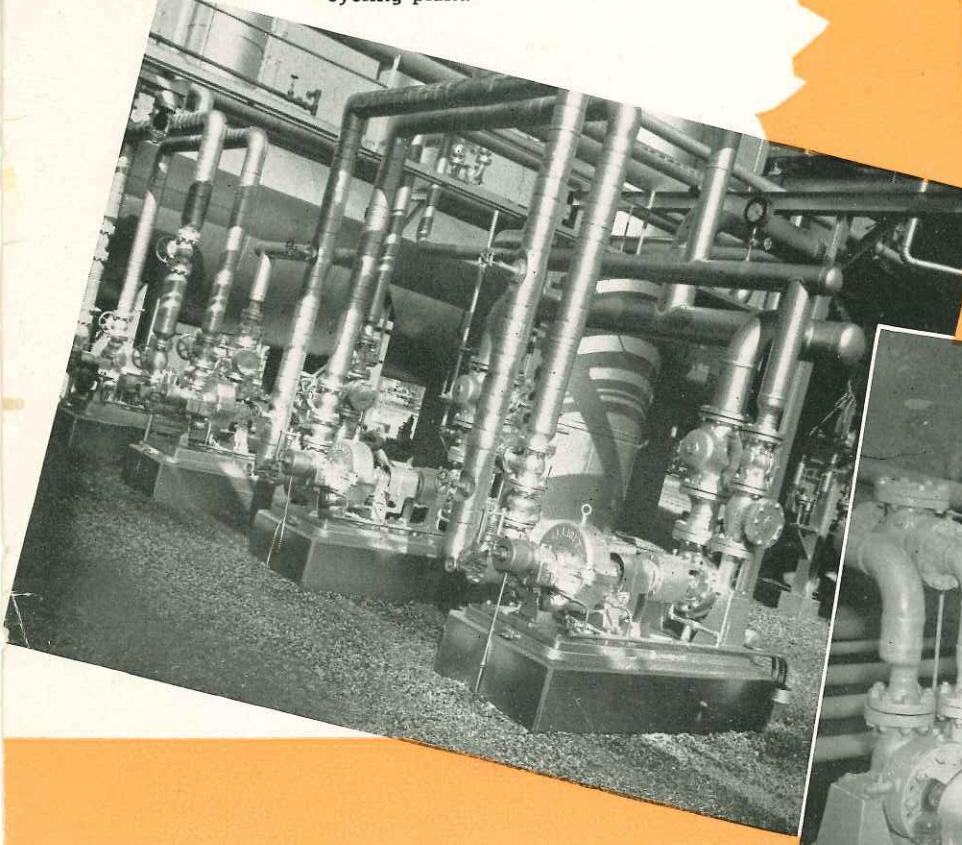
Two rich-oil pumps on transfer service between stabilizer and still.



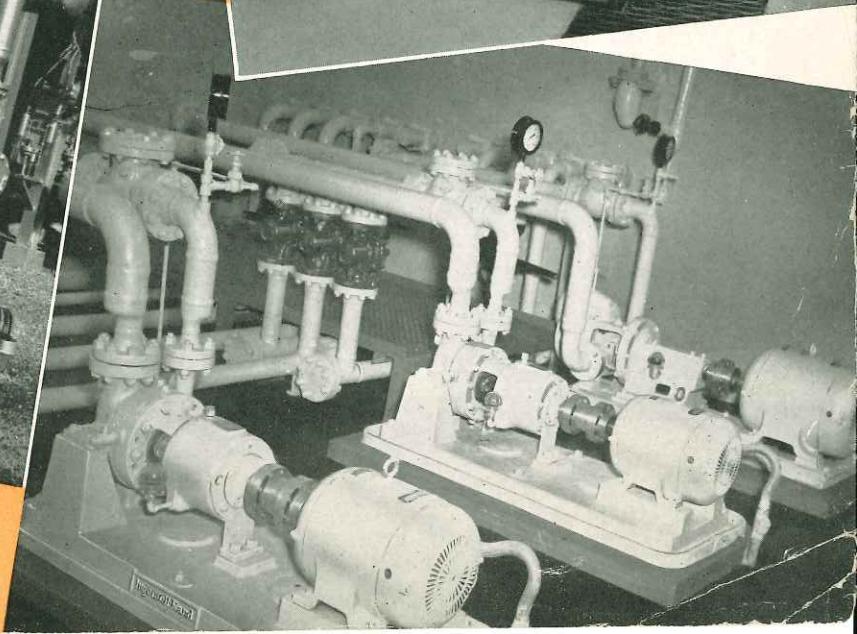
A line of process pumps in a catalytic cracking plant.



Four process pumps installed at a cycling plant.



Two process pumps and an I-R two-stage pump used on loading service.



# Ingersoll-Rand

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### Air- and Gas-Lift Pumps

### Blowers (Air and Gas)

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Motorblowers  
Turbo-Blowers  
Turbo-Compressors

### Core Drills

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Coroc  
Explorer  
Diamond  
Manhole  
Pavement-Testing  
Prospecting  
Shaft-Work

### Compressors (Air and Gas) (Air-Cooled and Water-Cooled Types)

Ammonia  
Automotive Types  
Combined Engine-Compressor  
Units for Steam, Gas, and  
Oil Drive  
Direct-Connected Electric and  
Belted  
High- and Low-Pressure  
Mine-Car  
Mobil-Air  
Motorcompressors  
Portable  
Single- and Multi-Stage  
Vacuum Pumps

### Concrete Busters (See also Paving Breakers)

### Condensers

Barometric, Counter-Current  
Disc-Flow & Ejector-Jet types  
Marine & Stationary  
Surface, Heart-Shape & Cross-  
Flow

### Drill Steel and Jackrods

(See also Jackbits and Jackrods)

Engines  
Diesel, Stationary and Marine  
Gas  
Heat Exchangers for Engines

Hoists  
Air-Bloc  
Air- and Electric-Driven  
Air-Motor (Direct-Lift)  
Gasoline- and Oil-Engine-  
Driven

Scrapers  
Single-, 2- & 3-Drum  
Slusher  
Tugger  
Utility

### Jackbits and Jackrods

Drill Steel Cutter  
Drill Steel Shank Grinders  
Jackbits (Detachable Bits)  
Jackbit Grinders  
Jackfurnace (for Jackbits)  
Jackmills (Hot mills for Jack-  
bits)  
Jackrods (Drill rods threaded  
for Jackbits)  
Jackrod Threading Equip't

### Paving Breakers

Demolition Tools  
Cushioned-Air

### Pile Drivers

### Pneumatic Tools

Accessories and Hose  
Angle Attachments  
Backfill Tamers  
Chipping Hammers  
Calking Hammers  
Clay Spades  
Concrete Vibrators  
Core Breakers  
Diggers  
Drills, Multi-Vane  
Drill-Steel Cutter  
Grinders, Multi-Vane  
Impact Wrenches  
Riveters and Holders-On  
Sanders  
Sand Rammers  
Scaling Hammers  
Screw Drivers & Nut Setters  
Stationary Motors  
Sump Pumps  
Surfacing  
Wire Brushes  
Wood Borers  
Wrenches, Torque and Impact

### Pumps (Cameron)

Boiler-Feed  
Brewery  
Centrifugal  
Chemical  
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Condensate-Return  
Coolant  
General Service  
High-Pressure  
Hot-Oil  
Marine  
Mine

### Pumps (Cont.)

Motorpumps  
Paper-Stock  
Pipe-Line  
Refinery  
Sump Pump (Air-Operated)

### Receivers, (Air and Gas)

Ammonia Compressors  
Steam-Jet Water-Vapor

### Rock Drills

Accessories and Hose  
Drifters  
Jackbits  
Jackhammers  
Jacklegs  
Mountings  
Oil-IR (Air-Line Lubricator)  
Paving Breakers (Cushioned  
Air)  
Pickhammers  
Pile Drivers  
Power-Feed  
Stophammers  
Submarine  
Tunnel-IR (Drifter)  
Wagon Mountings

### Sharpeners and Furnaces (for Jackrods, Rock Drill Steels and Bits)

Tie-Tamper Units  
Compressors, Railway  
Mounting  
Crawl-Air Compressors  
Pneumatic Tie Tamper  
Rail Drills  
Spike Drivers  
Spottamper Compressors  
Track Wrenches

### Vacuum Pumps

Steam-Jet Ejectors

Reciprocating Dry